EXHIBIT B

US008838976B2

(12) **United States Patent**
Etchegoyen

(10) **Patent No.: US 8,838,976 B2**
(45) **Date of Patent: Sep. 16, 2014**

(54) **WEB CONTENT ACCESS USING A CLIENT DEVICE IDENTIFIER**

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(73) Assignee: **Uniloc Luxembourg S.A.**, Luxembourg (LU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 699 days.

(21) Appl. No.: **12/703,470**

(22) Filed: **Feb. 10, 2010**

(65) **Prior Publication Data**

US 2010/0229224 A1 Sep. 9, 2010

Related U.S. Application Data

(60) Provisional application No. 61/151,449, filed on Feb. 10, 2009.

(51) **Int. Cl.**

H04L 9/32	(2006.01)
H04L 29/06	(2006.01)
H04L 29/08	(2006.01)
G06F 21/73	(2013.01)
G06F 21/31	(2013.01)

(52) **U.S. Cl.**

CPC ***H04L 63/102*** (2013.01); ***H04L 67/306*** (2013.01); *G06F 2221/2129* (2013.01); ***H04L 67/02*** (2013.01); ***G06F 21/73*** (2013.01); ***H04L 67/303*** (2013.01); ***G06F 21/31*** (2013.01)

USPC **713/176**; 726/5; 726/7; 713/168

(58) **Field of Classification Search**

None

See application file for complete search history.

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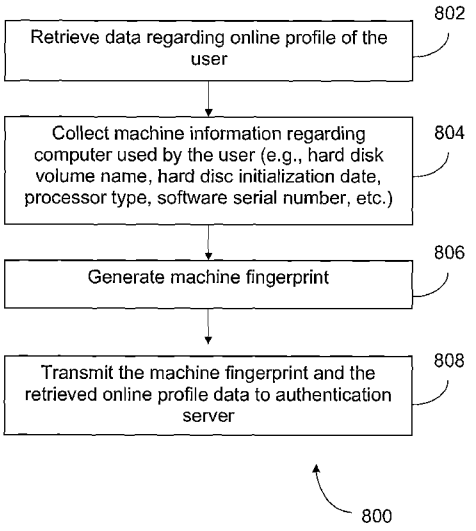
(57) **ABSTRACT**

Systems and methods are provided for controlling access to online services. For example, the system may include an application running on a user computer (**130**) that collects platform data (e.g. physical device parameters) and generates a machine fingerprint (stage **602**). The computer (**130**) may send the machine fingerprint to the authentication server (**110**). The server (**110**) may associate the received machine fingerprint with the appropriate online account information received from a host server (**120**) or the like (stage **604**). The authentication server (**110**) may send the appropriate registration status signal to the host server (**120**), which in turn may update the online profile information to include the user's registration status (stage **606**).

13 Claims, 10 Drawing Sheets



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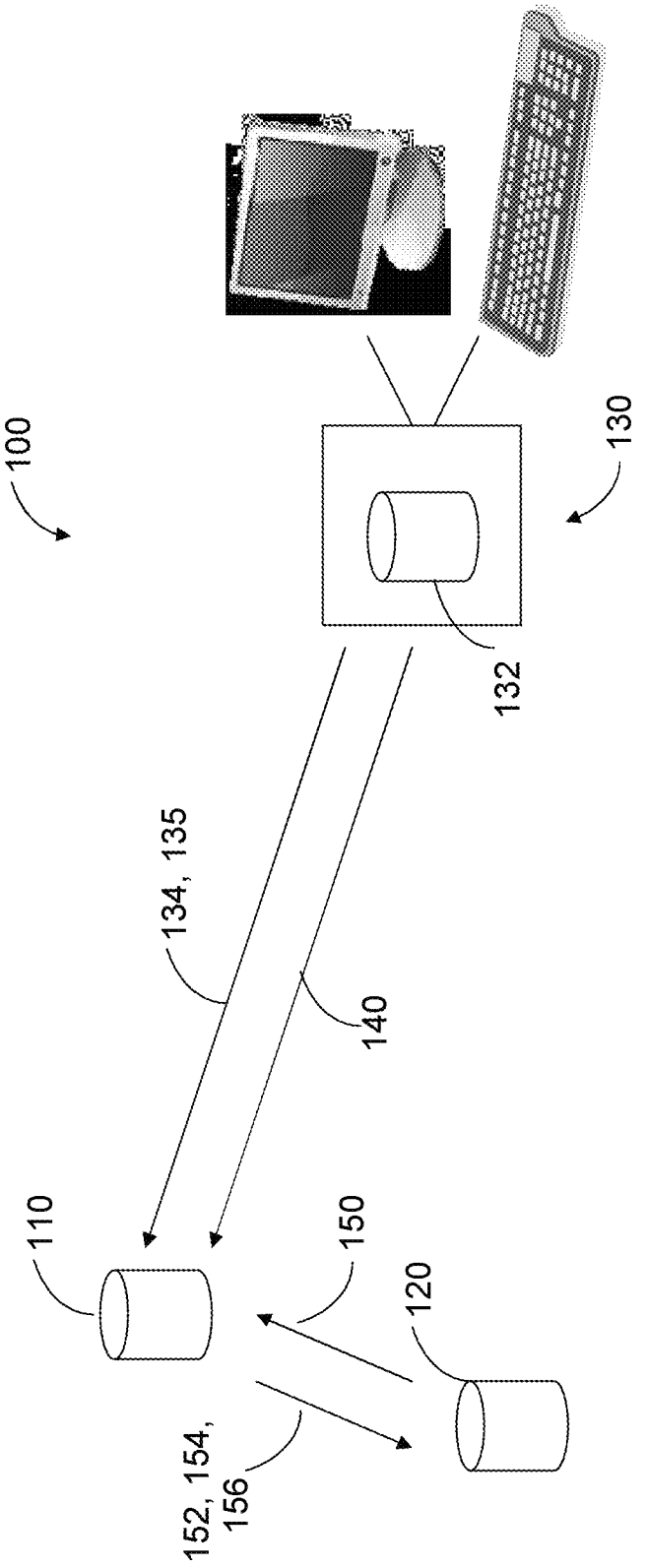
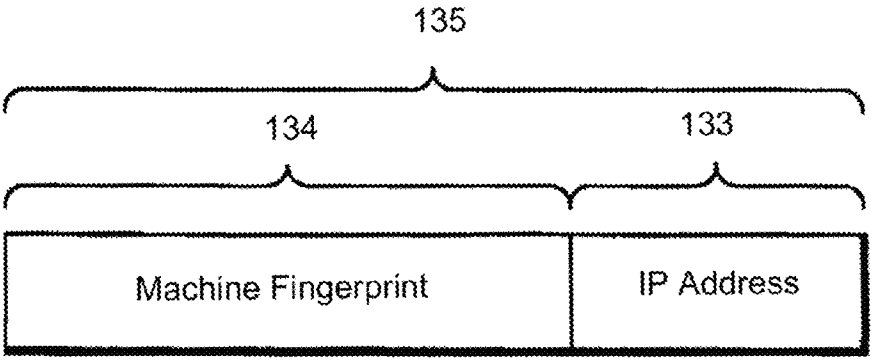


FIGURE 1



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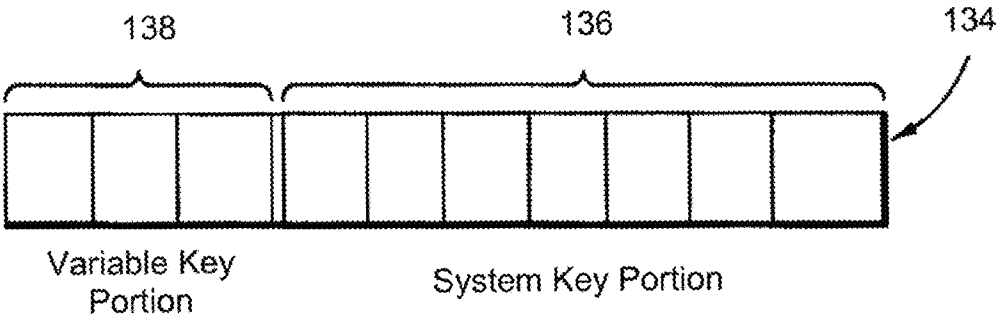

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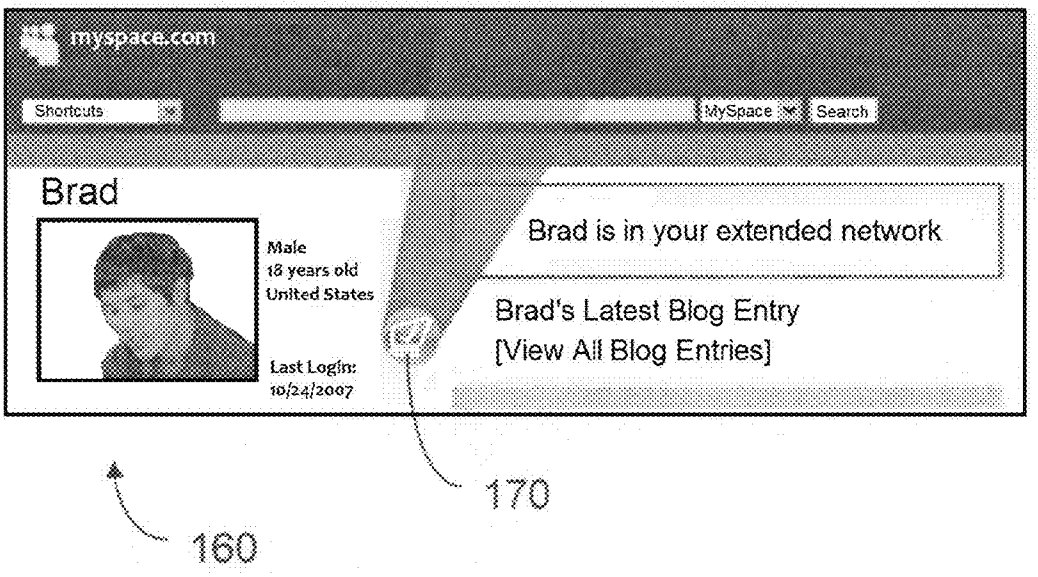


FIGURE 4

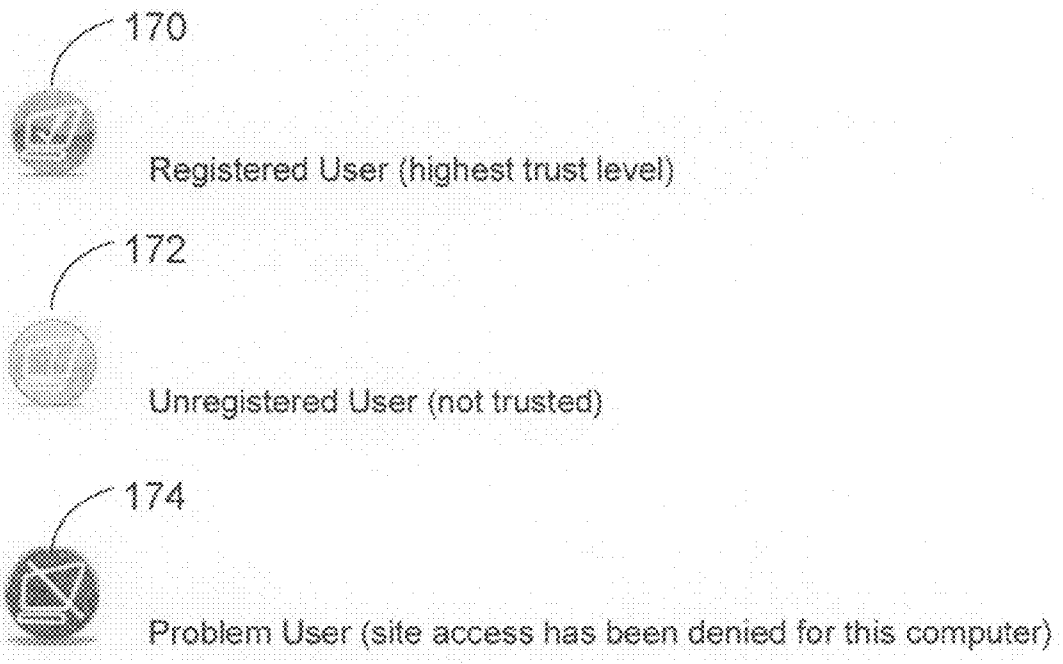


FIGURE 5

Figure 6A

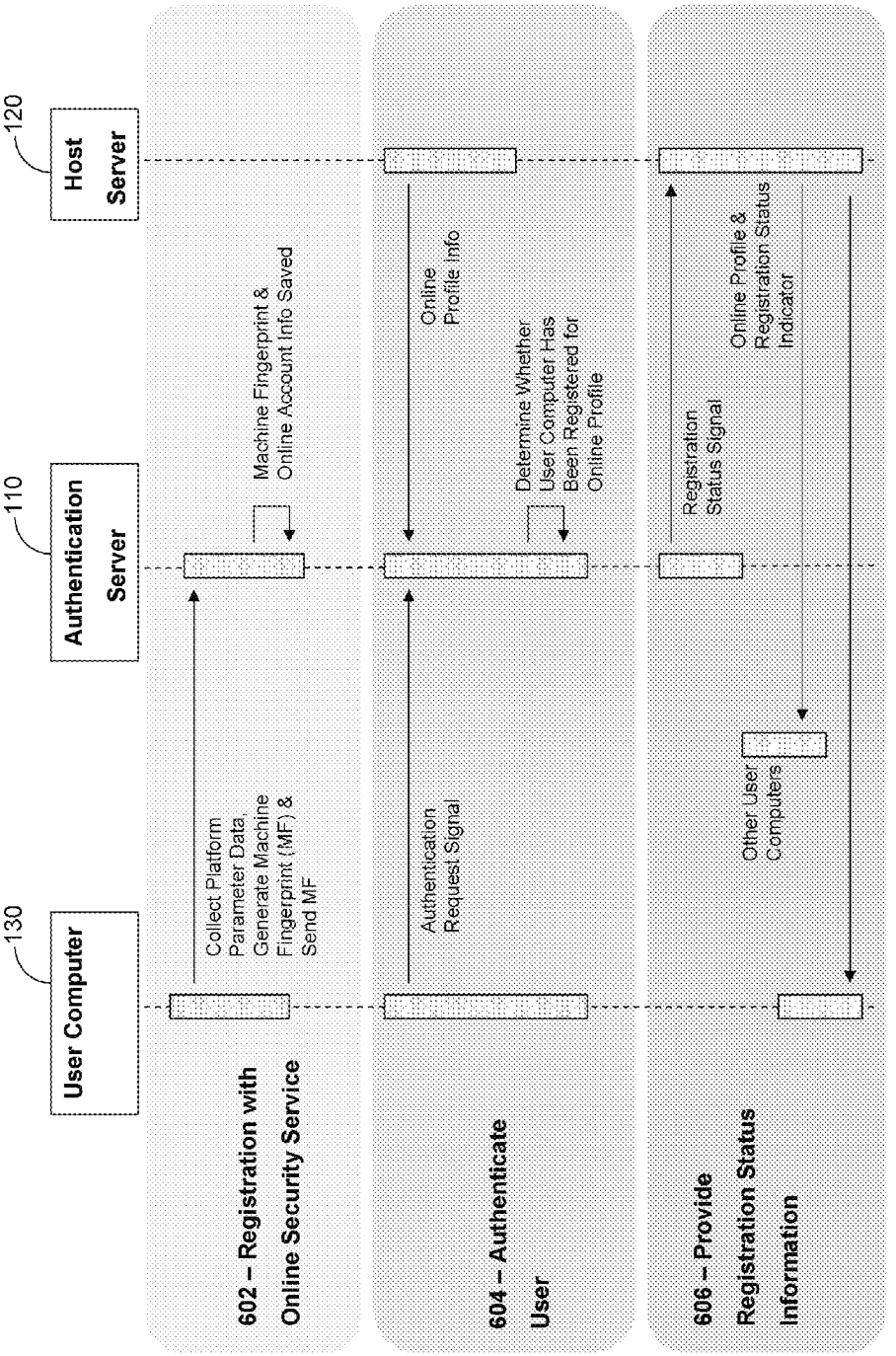

User Computer
130
Authentication Server
110
Host Server
120
602 – Registration with Online Security Service
Collect Platform Parameter Data, Generate Machine Fingerprint (MF) & Send MF
Machine Fingerprint & Online Account Info Saved
604 – Authenticate User
Authentication Request Signal
Online Profile Info
Determine Whether User Computer Has Been Registered for Online Profile
606 – Provide Registration Status Information
Registration Status Signal
Online Profile & Registration Status Indicator
Other User Computers

Figure 6B

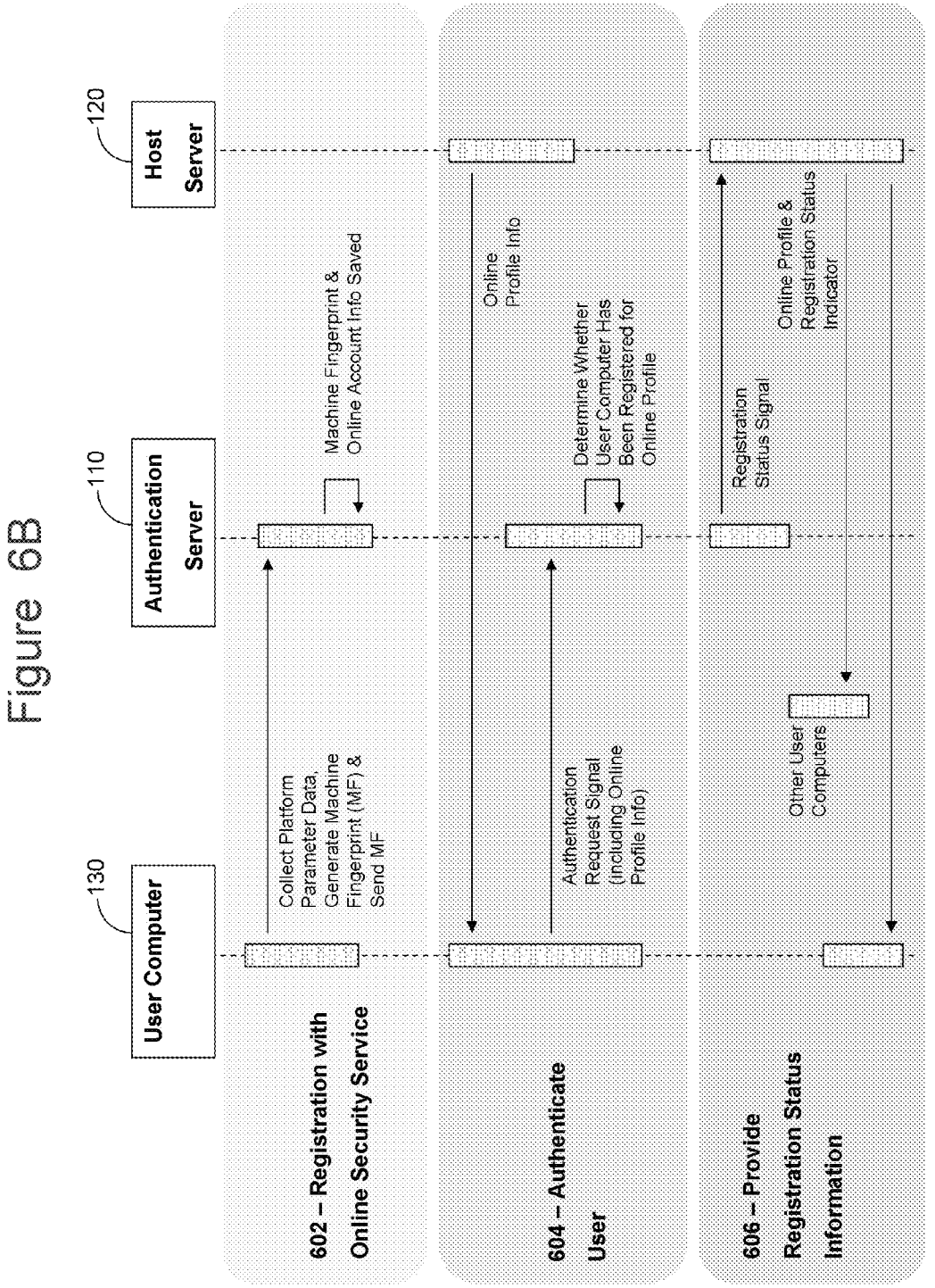

User Computer
130
Authentication Server
110
Host Server
120
602 – Registration with Online Security Service
Collect Platform Parameter Data, Generate Machine Fingerprint (MF) & Send MF
Machine Fingerprint & Online Account Info Saved
604 – Authenticate User
Authentication Request Signal (including Online Profile Info)
Determine Whether User Computer Has Been Registered for Online Profile
Online Profile Info
606 – Provide Registration Status Information
Registration Status Signal
Online Profile & Registration Status Indicator
Other User Computers

Figure 7A

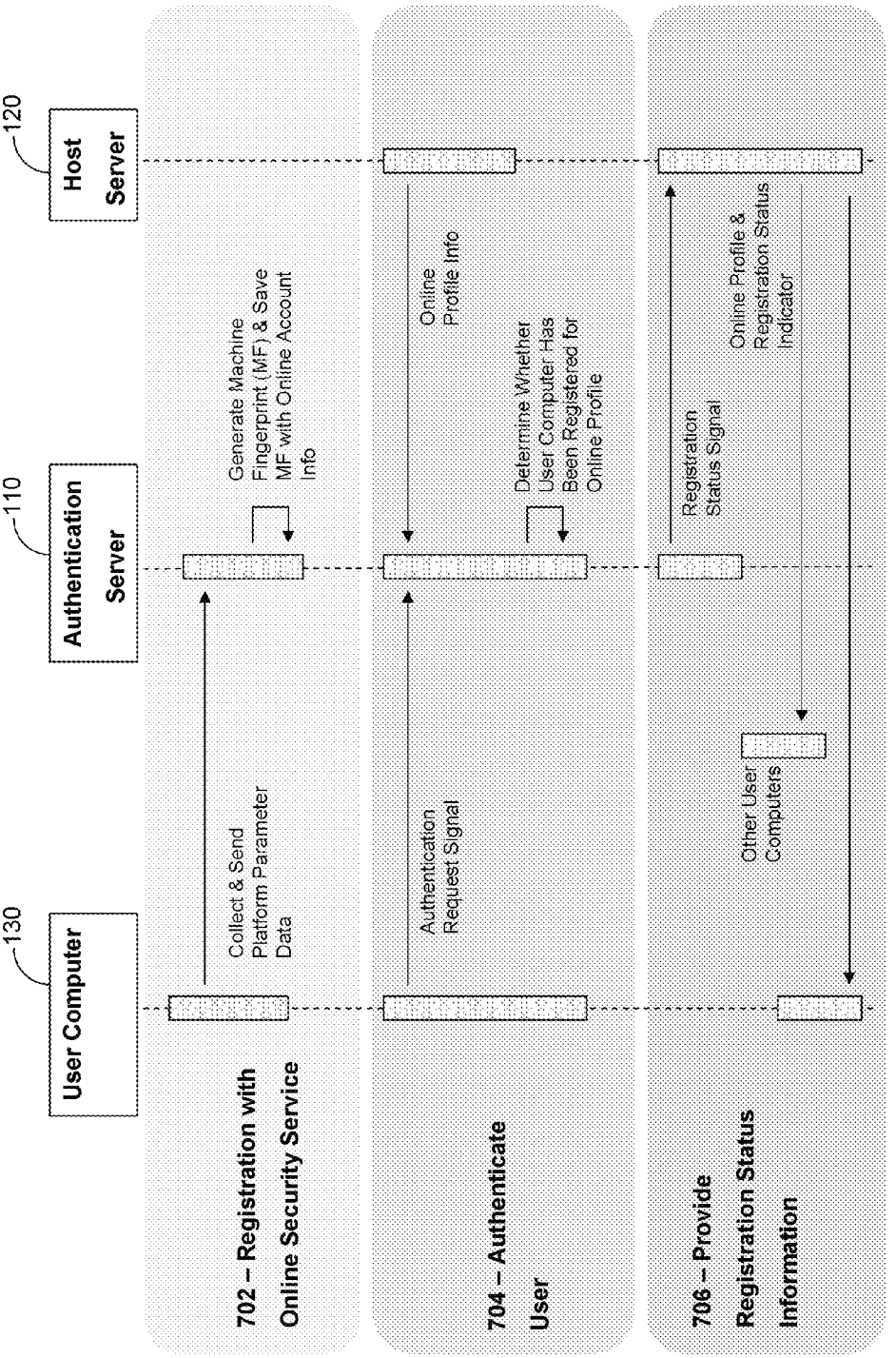
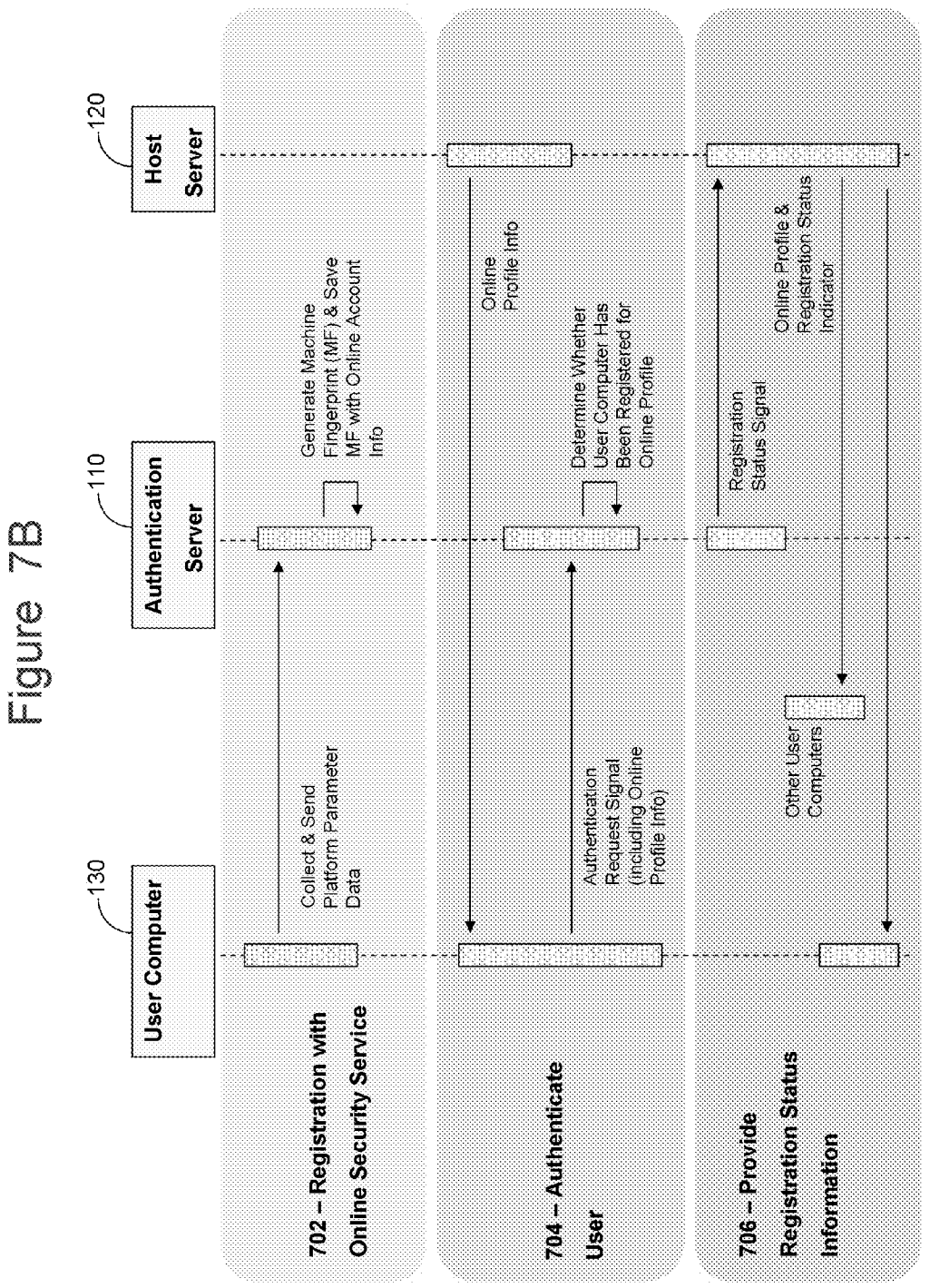

120
Host Server
110
Authentication Server
130
User Computer
Collect & Send Platform Parameter Data
Generate Machine Fingerprint (MF) & Save MF with Online Account Info
Authentication Request Signal
Online Profile Info
Determine Whether User Computer Has Been Registered for Online Profile
Registration Status Signal
Online Profile & Registration Status Indicator
Other User Computers
702 – Registration with Online Security Service
704 – Authenticate User
706 – Provide Registration Status Information

Figure 7B


User Computer
130
Authentication Server
110
Host Server
120
Collect & Send Platform Parameter Data
Generate Machine Fingerprint (MF) & Save MF with Online Account Info
Online Profile Info
Authentication Request Signal (including Online Profile Info)
Determine Whether User Computer Has Been Registered for Online Profile
Registration Status Signal
Online Profile & Registration Status Indicator
Other User Computers
702 – Registration with Online Security Service
704 – Authenticate User
706 – Provide Registration Status Information

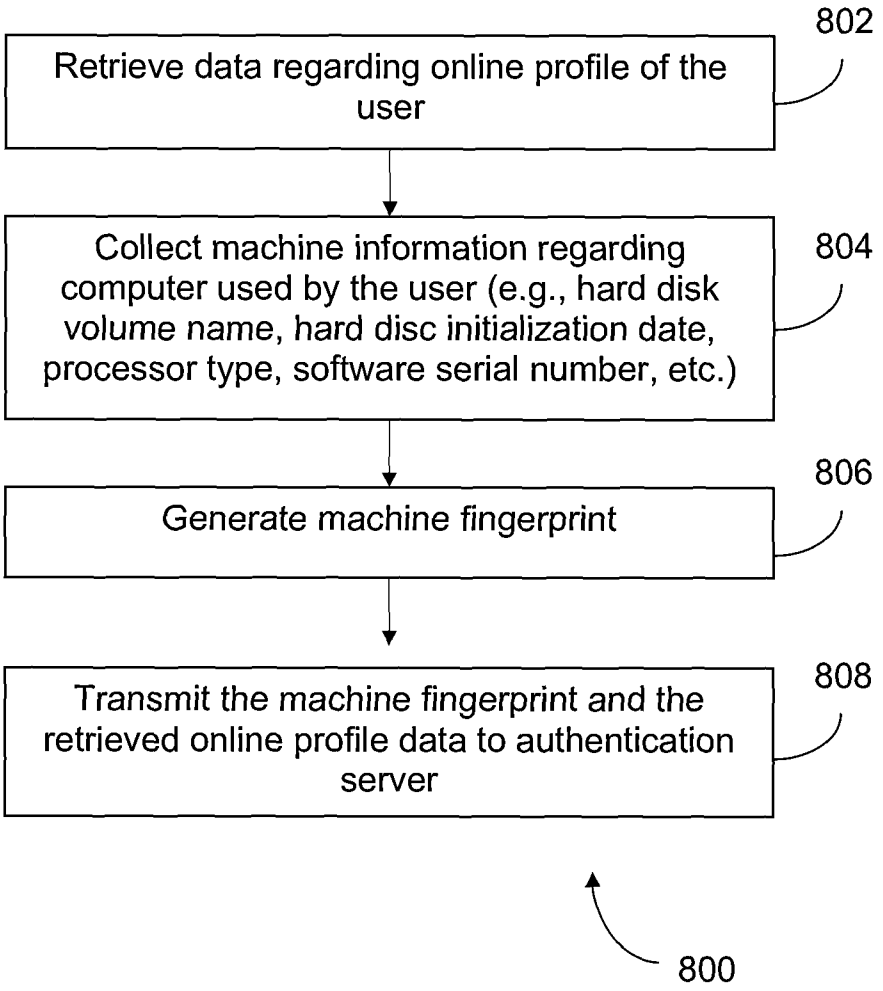

802
Retrieve data regarding online profile of the user
804
Collect machine information regarding computer used by the user (e.g., hard disk volume name, hard disc initialization date, processor type, software serial number, etc.)
806
Generate machine fingerprint
808
Transmit the machine fingerprint and the retrieved online profile data to authentication server
800

FIGURE 8

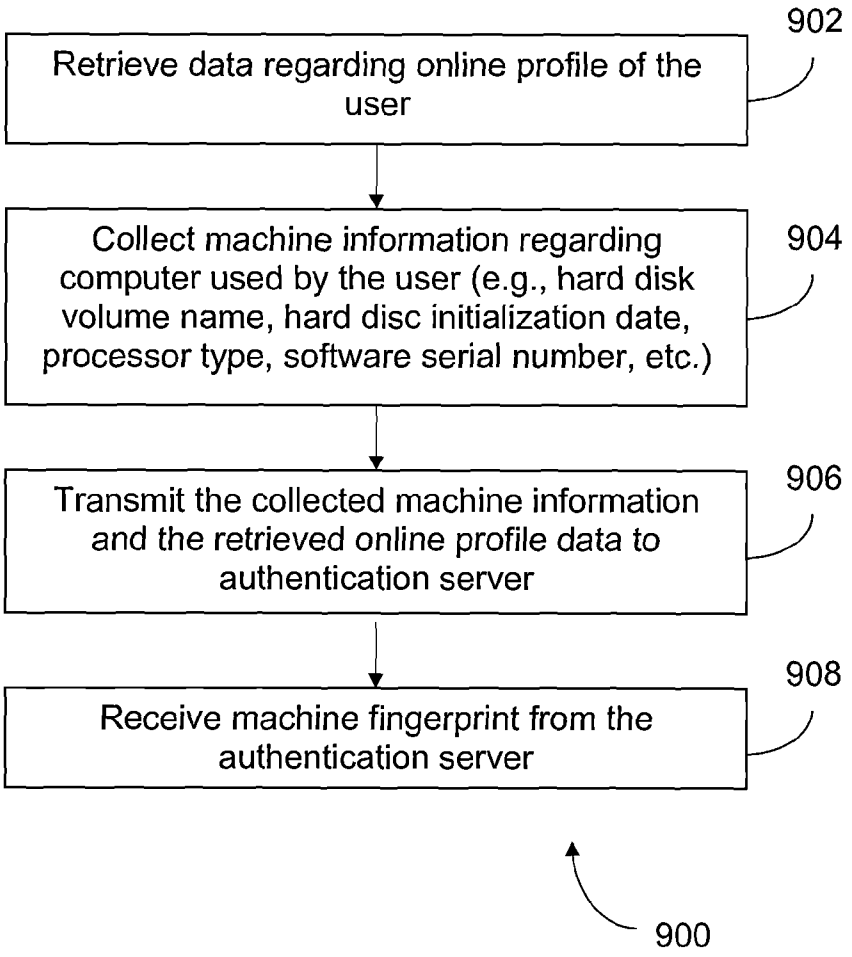

902
Retrieve data regarding online profile of the user
904
Collect machine information regarding computer used by the user (e.g., hard disk volume name, hard disc initialization date, processor type, software serial number, etc.)
906
Transmit the collected machine information and the retrieved online profile data to authentication server
908
Receive machine fingerprint from the authentication server
900

FIGURE 9

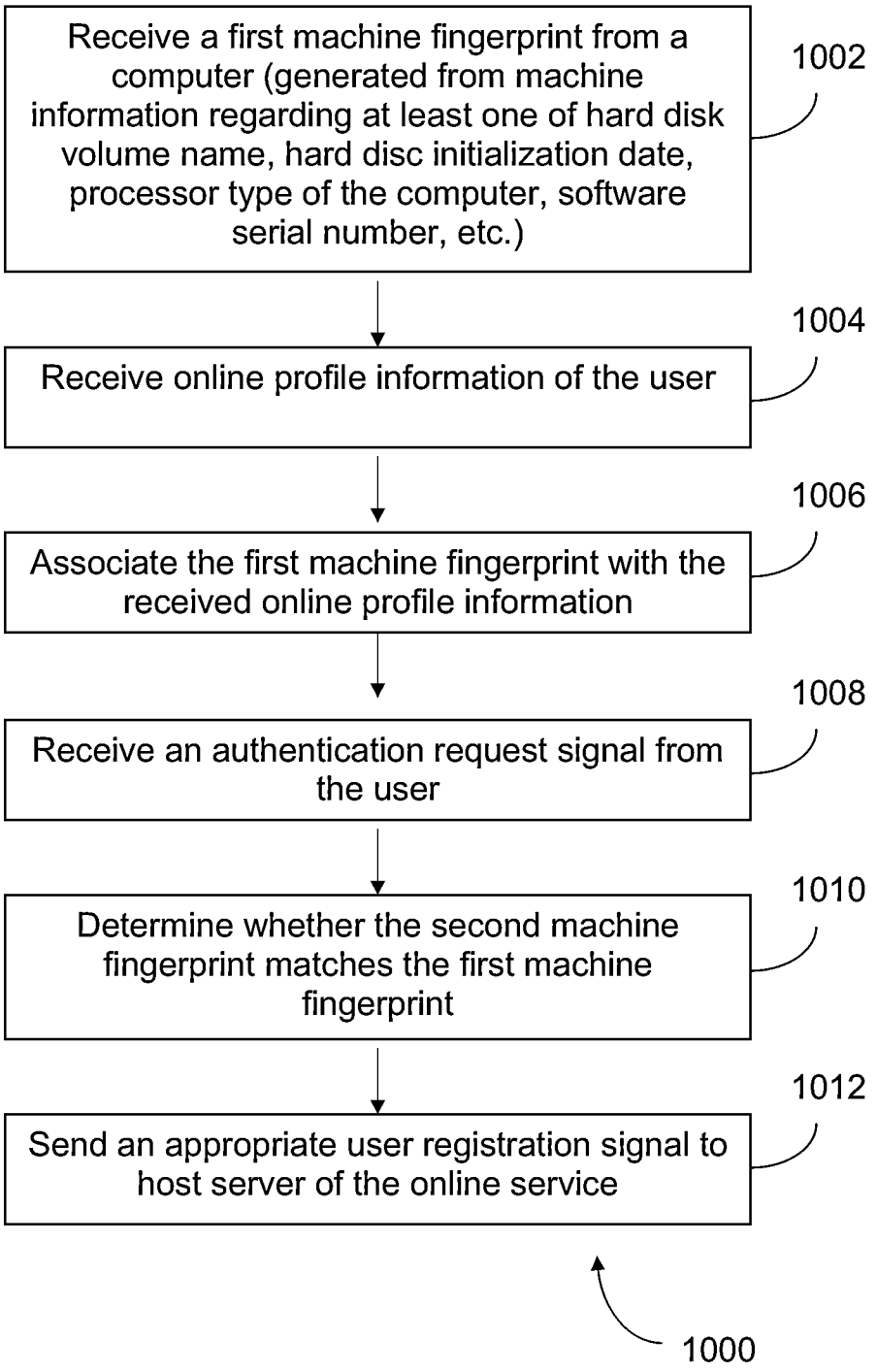

Receive a first machine fingerprint from a computer (generated from machine information regarding at least one of hard disk volume name, hard disc initialization date, processor type of the computer, software serial number, etc.)
1002
Receive online profile information of the user
1004
Associate the first machine fingerprint with the received online profile information
1006
Receive an authentication request signal from the user
1008
Determine whether the second machine fingerprint matches the first machine fingerprint
1010
Send an appropriate user registration signal to host server of the online service
1012
1000

FIGURE 10

WEB CONTENT ACCESS USING A CLIENT DEVICE IDENTIFIER

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application claims benefit of U.S. Provisional Patent Application No. 61/151,449, filed Feb. 10, 2009, which is specifically incorporated by reference herein in its entirety.

BACKGROUND

1. Field of the Invention

The present invention is directed toward systems for authenticating online service users, and more particularly, to a system that interfaces with the each user's network device to measure the client system's hardware configuration and thereby generate a device identifier that can be used to authenticate the user.

2. Description of the Related Art

Currently, there are limited ways to authenticate online users of services and content, such as social networking sites, auction sites, shopping sites, etc. One known approach has been to require a credit card to create an account or authenticate an account user. The hope is that the collection of personally identifiable information, such as credit card data, driver's licenses, etc. will keep online users accountable for their actions. However, such approaches may be inconvenient for all users, including legitimate ones who do not have a credit card or do not wish to provide personal information, and thereby may drive potential legitimate users away.

Accordingly, it would be very desirable to provide an authentication service that provides reliable identification of users, without being unduly burdensome for online service users. Such a service may be used alone, or in conjunction with other security/authentication measures.

SUMMARY OF THE INVENTION

In accordance with one aspect of the embodiments described herein, there is provided a method for authenticating a user of an online service, comprising: retrieving data regarding an online profile of the user for the online service; and collecting machine information regarding a network device (e.g., a computer) being used by the user to access the online service, the step of collecting machine information comprising checking at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number. The step of collecting machine information may further comprise checking the IP address of the network device. The method may further comprise generating a device identifier based at least in part on the collected machine information. The generated device identifier may be stored in a hidden file directory of the computer. The method may further comprise transmitting the generated device identifier and the retrieved online profile data to an authentication server.

In accordance with another aspect of the embodiments described herein, there is provided an applet comprising executable code for a Java Virtual Machine (JVM) to: retrieve data regarding an online profile of the user for the online service; and collect machine information regarding a computer being used by the user to access the online service, the step of collecting machine information comprising checking at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number. The step of collecting machine information may further comprise checking the IP address of the computer. The applet may further comprise executable code for the JVM to generate a device identifier based at least in part on the collected machine information. The generated device identifier may be stored in a hidden file directory of the computer. The applet may further comprise executable code for the JVM to transmit the generated device identifier and the retrieved online profile data to an authentication server.

In accordance with another aspect of the embodiments described herein, there is provided a method for authenticating a user of an online service, comprising: receiving a first device identifier from a computer being used by the user, the first device identifier being generated from machine information regarding at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number. The first device identifier may be based at least in part on the IP address of the computer. The method may further comprise receiving online profile information of the user for the online service, and associating the first device identifier with the received online profile information. The method may further comprise receiving an authentication request signal from the user, the request signal comprising a second device identifier. When the second device identifier matches the first device identifier, a registered user signal may be transmitted to a server hosting the online service, the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information.

In accordance with another aspect of the embodiments described herein, there is provided a system for authenticating a user of an online service on a computer network, comprising a server connected to the computer network. The server may be adapted to provide the functions of: receive a first device identifier from a computer being used by the user, the first device identifier being generated from machine information regarding at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number. The first device identifier may be generated at least in part on the IP address of the computer. The system may be further adapted to provide the functions of: receive online profile information of the user for the online service; associate the first device identifier with the received online profile information; and receive an authentication request signal from the user, the request signal comprising a second device identifier. When the second device identifier matches the first device identifier, a registered user signal may be transmitted to a server hosting the online service, the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information.

In accordance with another aspect of the embodiments described herein, there is provided a method for controlling access to web content or web site services, comprising: for a user using a machine to attempt to access the web content, providing an opportunity to create a device identifier. When the user opts to create the device identifier, the method may comprise gathering information regarding platform parameters of the machine and generating a unique device identifier based at least in part on the platform parameters. The generated device identifier may be stored on the machine as a key file and/or at a remote site as a remote key file. When the user attempts to access the web content, the method may further comprise: comparing the key file on the user's machine with the remote key file; and allowing access to the web content if the key file on the user's machine matches the remote key file.

In accordance with another aspect of the embodiments described herein, there is provided a method for verifying online identity, comprising: for a user using a machine to attempt to access a social networking site, providing an opportunity to create a device identifier. When the user opts to create the device identifier, the method may further comprise gathering information regarding platform parameters of the machine and generating a unique device identifier based at least in part on the platform parameters. The generated device identifier may be stored on the machine as a key file and/or at a remote site as a remote key file. When the user accesses the social networking site, the method may further comprise: comparing the key file on the user's machine with the remote key file; and allowing access to the social networking site when the key file on the user's machine matches the remote key file.

The foregoing methods and steps thereof may be encoded as executable instructions in a computer-readable media, such as, for example, in a hard drive or in a portable media, such as an optical disk, electronic memory device, or magnetic tape, disk, or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** provides a block diagram of an exemplary system for authenticating online service users.

FIG. **2** provides a block diagram of an exemplary machine signature comprising a device identifier and an IP address.

FIG. **3** provides a block diagram of an exemplary device identifier comprising a variable key portion and a system key portion.

FIG. **4** illustrates an exemplary screenshot showing a display of an online profile with an exemplary registered user indicator.

FIG. **5** provides exemplary icons that may be used to indicate the registration status of online service users.

FIG. **6**A provides a sequence diagram for an exemplary system for authenticating online service users, wherein the device identifier is generated by an applet on the user's computer.

FIG. **6**B provides a sequence diagram for another exemplary system for authenticating online service users, wherein the device identifier is generated by an applet on the user's computer.

FIG. **7**A provides a sequence diagram for an exemplary system for authenticating online service users, wherein the device identifier is generated at an authentication server.

FIG. **7**B provides a sequence diagram for another exemplary system for authenticating online service users, wherein the device identifier is generated at an authentication server.

FIG. **8** is a flow chart illustrating steps of one approach to generating device identifiers for computers used by online service users.

FIG. **9** is a flow chart illustrating steps of another approach to generating device identifiers for computers used by online service users.

FIG. **10** is a flow chart illustrating steps of one approach to authenticating online service users.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present technology provides for an improved system and method of identifying or tracking online service users. Specifically, the present technology utilizes measurable hardware characteristics of a local client that any online user of any age has in front of them when accessing the Internet, such as their connected computer or computing device for identification and user tracking. The present technology allows users to register their computer(s) or other client hardware and associate the registered computers with one or more online accounts, such as accounts for social networking, online auctioning or shopping accounts, etc.

For example, in the context of social networking sites, such as MySpace®, Facebook®, Orkut®, Friendster®, or Xanga®, the present technology gives parents and social networking site administrators the power to protect their children from online threats. It does this by letting online users take the extra security step of linking their accounts to the actual computers or other client hardware they use, giving their online friends a higher level of trust that they are who they say they are, and not an online fraudster or predator.

In accordance with one aspect of the present technology, there is provided a system and method for authenticating the identity of web site users by utilizing one or more parameters of the users' respective client hardware. In one embodiment, shown in FIG. **1**, there is provided a system **100** with an authentication server **110** that is in operative communication with numerous other servers, such as server **120**, as well as user computers, such as exemplary user computer **130**. The user computer **130** comprises a web browser along with an application or an applet **132** that that can run within the web browser.

For example, suppose server **120** hosts a social networking site. The authentication server **110** along with an applet **132** running on the user computer **130** may give parents and social networking sites the tools for protecting children from online threats. The system **100** may operate to link users' online accounts to the actual computers or machines they use to access the networking website.

The applet **132** may include a registration routine that collects information regarding the user's computer **130** by checking a number of parameters which are expected to be unique to the user machine environment. The parameters checked may include, for example, hard disk volume name, user name, computer name, user password, hard disk initialization date, etc. The collected information may include information that identifies the hardware comprising the platform on which the web browser runs, such as, for example, CPU number (where available), or unique parameters associated with the firmware in use. The system information may further include system configuration information, such as amount of memory, type of processor, software or operating system serial number, etc.

Based on the collected information, the applet **132** may generate a device identifier, such as a machine fingerprint **134**, that is unique for the user computer **130**. In the alternative, or in addition, the applet **132** may gather and send the system parameters to the authentication server **110**, which in turn generates the machine fingerprint **134**. The machine fingerprint **134** may be stored in a hidden directory of the computer **130** and/or at a remote location, such as the authentication server **110**, as explained below. The machine fingerprint **134** may incorporate the computer's IP address to add another layer of specificity to machine's signature. In the alternative, or in addition, the machine fingerprint **134** may be combined with the IP address **133** of the computer **130** to generate a machine signature **135** for the computer **130**, as shown in FIG. **2**.

It is noted that an application (e.g., applet **132**) running on the network device (e.g., computer **130**) or otherwise having access to the network device's hardware and file system may generate a unique device identifier (e.g., machine fingerprint **134**) using a process that operates on data indicative of the

network device's configuration and hardware. The device identifier may be generated using a combination of user-configurable and non-user-configurable machine parameters as input to a process that results in the device identifier, which may be expressed in digital data as a binary number. Each machine parameter is data determined by a hardware component, software component, or data component specific to the device that the unique identifier pertains to. Machine parameters may be selected based on the target device system configuration such that the resulting device identifier has a very high probability (e.g., greater than 99.999%) of being unique to the target device. In addition, the machine parameters may be selected such that the device identifier includes at least a stable unique portion up to and including the entire identifier, that has a very high probability of remaining unchanged during normal operation of the target device. Thus, the resulting device identifier should be highly specific, unique, reproducible and stable as a result of properly selecting the machine parameters.

The application for generating the device identifier may also operate on the collected parameters with one or more algorithms to generate the device identifier. This process may include at least one irreversible transformation, such as, for example, a cryptographic hash function, such that the input machine parameters cannot be derived from the resulting device identifier. Each identifier, to a very high degree of certainty, cannot be generated except by the suitably configured application operating on or otherwise having had access to the same network device for which the device identifier was first generated. Conversely, each identifier, again to a very high degree of certainty, can be successfully reproduced by the suitably configured application operating or otherwise having access to the same network device on which the identifier was first generated.

The application may operate by performing a system scan to determine a present configuration of the field security device. The application may then select the machine parameters to be used as input for generating the unique device identifier. Selection of parameters may vary depending on the system configuration. Once the parameters are selected, the application may generate the identifier.

Further, generating the device identifier may also be described as generating a device fingerprint and may entail the sampling of physical, non-user configurable properties as well as a variety of additional parameters such as uniquely generated hashes and time sensitive values. Physical device parameters available for sampling may include, for example, unique manufacturer characteristics, carbon and silicone degradation and small device failures.

The process of measuring carbon and silicone degradation may be accomplished by measuring a chip's ability to process complex mathematical computations, and its ability to respond to intensive time variable computations. These processes measure how fast electricity travels through the carbon. Using variable offsets to compensate for factors such as heat and additional stresses placed on a chip during the sampling process allows for each and every benchmark to reproduce the expected values. During a standard operating lifetime, the process of passing electricity through the various switches causes a computer chip to degrade. These degradations manifest as gradually slower speeds that extend the processing time required to compute various benchmarking algorithms.

In addition to the chip benchmarking and degradation measurements, the process for generating a device identifier may include measuring physical, non-user-configurable characteristics of disk drives and solid state memory devices. Each data storage device has a large variety of damage and unusable data sectors that are nearly unique to each physical unit. The ability to measure and compare values for damaged sectors and data storage failures provides a method for identifying storage devices.

Device parameter sampling, damage measurement and chip benchmarking make up just a part of device fingerprinting technologies described herein. These tools may be further extended by the use of complex encryption algorithms to convolute the device identifier values during transmission and comparisons. Such encryption processes may be used in conjunction with random sampling and key generations.

The device identifier may be generated by utilizing machine parameters associated with one or more of the following: machine model; machine serial number; machine copyright; machine ROM version; machine bus speed; machine details; machine manufacturer; machine ROM release date; machine ROM size; machine UUID; and machine service tag.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: CPU ID; CPU model; CPU details; CPU actual speed; CPU family; CPU manufacturer; CPU voltage; and CPU external clock.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: memory model; memory slots; memory total; and memory details.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: video model; video details; display model; display details; audio model; and audio details.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: network model; network address; Bluetooth address; BlackBox model; BlackBox serial; BlackBox details; BlackBox damage map; BlackBox volume name; NetStore details; and NetStore volume name.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: optical model; optical serial; optical details; keyboard model; keyboard details; mouse model; mouse details; printer details; and scanner details.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: baseboard manufacturer; baseboard product name; baseboard version; baseboard serial number; and baseboard asset tag.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: chassis manufacturer; chassis type; chassis version; and chassis serial number.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: IDE controller; SATA controller; RAID controller; and SCSI controller.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: port connector designator; port connector type; port connector port type; and system slot type.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: cache level; cache size; cache max size; cache SRAM type; and cache error correction type.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the fol-

lowing: fan; PCMCIA; modem; portable battery; tape drive; USB controller; and USB hub.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: device model; device model IMEI; device model IMSI; and device model LCD.

The device identifier may also be generated by utilizing machine parameters associated with one or more of the following: wireless 802.11; webcam; game controller; silicone serial; and PCI controller.

In one example, the device identifier may also be generated by utilizing machine parameters associated with one or more of the following: machine model, processor model, processor details, processor speed, memory model, memory total, network model of each Ethernet interface, network MAC address of each Ethernet interface, BlackBox Model, BlackBox Serial (e.g., using Dallas Silicone Serial DS-2401 chipset or the like), OS install date, nonce value, and nonce time of day.

With reference to FIG. **3**, in one embodiment, the device identifier (e.g., the machine fingerprint **134**) may include two components—namely, a system key portion **136** and a variable key portion **138**. The variable key portion **138** may be generated at the time of registration of computer **130** by reference to a variable platform parameter, such as via reference to system time information, although other parameters which are variable may be utilized in other embodiments. The system key portion **136** may include the above described parameters expected to be unique to the user machine **130**, such as, for example, hard disk volume name, user name, computer name, user password, hard disk initialization date, etc. Portions **136** and/or **138** may be combined with the IP address **133** of the computer **130** and/or other platform parameters to generate a machine signature **135**.

The applet **132** may prompt the user to register with an online security service, and may electronically send the machine fingerprint **134** and/or machine signature **135** and information regarding his/her online account(s) to the authentication server **110**, such as by using a secured network connection. The authentication server **110** may encrypt and store all such received data regarding machine fingerprints **134** and online accounts.

When the registered user then uses the computer **130** to access a social networking site running on server **120**, the applet **132** may detect that the machine fingerprint **134** has been created and transmitted to the authentication server **110**. The applet may detect that one or more online networking accounts are associated with the machine fingerprint **134** and have been registered for the user at the authentication server **110**.

Then, in response to the computer **130** accessing the server **120**, the applet **132** may transmit an authentication request signal **140** to the authentication server **110**. The authentication request signal **140** may include the machine fingerprint **134** and/or machine signature and online account profile information. Server **110** may further receive user identification (ID) or other basic online account profile information **150** from server **120**. By comparing the received profile information **150** from server **120** with the authentication request signal **140** from the computer **130**, the authentication server **120** may determine whether the computer **130** has been registered for a given online account. In the alternative, or in addition, the applet **132** may transmit an authentication request signal **140** to the server **120**, which in turn may communicate with the authentication server **110** to determine whether the user of computer **130** has registered with the online security service.

If the authentication server **110** verifies, based on the registered machine fingerprint **134** and any online networking accounts, that the computer **130** has been previously registered with the online security service for the online account that the user is trying to access, then the server **110** may send a registered user signal **152**, indicating a high trust level, to server **120**. If the authentication server **110** is not able to verify that the computer **130** has been previously registered with the online security service for the account that the user is trying to access, then the server **110** may send an unregistered user signal **154**, indicating that the user is not registered, to server **120**. In the alternative, or in addition, the server **110** may provide the user the opportunity to register the computer **130** with the online security service. If the authentication server **110** determines that the user's account has been flagged, such as, for example, when the website or online service access has been previously denied for computer **130**, then the server **110** may send a problem user signal **156**, indicating danger, to server **120**.

In response to the registered user signal **152**, unregistered signal **154**, or problem user signal **156** from the authentication server **110**, server **120** may update or supplement the user's profile to indicate whether or not the user has registered with the online security service. For example, with reference to FIG. **4** the user's online profile **160** on server **120** may be updated to include a registered user indicator, such as a registered user icon **170** (e.g., a computer screen with a check mark inside it) to indicate that the user is a registered user and that there is a high level of trust with this particular user. As shown in FIG. **5**, numerous types of icons with various shapes, motifs, and colors may be used to indicate whether the user is registered with the online security service. For example, an unregistered icon **172** (e.g., a computer screen with a question mark inside it) can be used to indicate that the user has not registered with the online security service. Similarly, a problem user icon **174** (e.g., a computer screen with a slash through it) may be used to indicate the user may pose a danger and should be avoided.

Online users displaying icon **170** on their online profile **160** may essentially convey to other website or online service users: "I am who I say I am because I am on my computer, and I am willing to be held accountable for my online actions." For normal and conscientious users, registration with the online security service is an easy choice. For malicious users, the creation of a computer fingerprint and registration with the online security service poses unacceptable risks.

Embodiments have been described herein in the context of online networking sites. However, it will be understood that the authentication methods and systems described herein may be applicable to any online service or site, particularly where online or user IDs are created and used. For example, the authentication technology described herein may be utilized in the context of an online auction or shopping sites, such as eBay or the like. Machine fingerprinting and user ID registration with an online security service may be used to authenticate buyers and sellers on such auction or shopping sites. Moreover, it will be understood that the technology described herein may be applicable to any situation where a computer user needs to be authenticated, and in particular where it would be desirable to authenticate that a person registering with or using an online service with a given identity is not using hardware used for malicious purposes in the past, or is using hardware consistent with the user's past behavior.

Embodiments of fingerprinting and authentication methods and systems have been described with reference to a user's computer. However, it will be understood that the fingerprinting and authentication approaches described herein

are applicable to computing devices in general, including but not limited to, desktops, laptops, tablet computers, PDAs, mobile devices, mobile phones, vehicle onboard computers, and any other network device capable of communication with a computer network.

It will be understood that the described system for authenticating the identify of web site users via utilization of parameters of the users' respective client hardware, can comprise any number of components or modules adapted to perform the authentication steps as will be known of ordinary skill in the art. For example, with reference to FIG. **6**A, there is provided one embodiment of a system wherein an application or applet running on the user computer **130** may collect platform parameter data regarding the computer **130** and generate a machine fingerprint (step **602**). The computer **130** may send the machine fingerprint to the authentication server **110**. The authentication server **110** may also receive online account information from the computer **130** and/or the host server **120**. The authentication server **110** may associate the received machine fingerprint with the appropriate online account information.

With continued reference to FIG. **6**A, at step **604**, in response to the computer **130** accessing the server **120**, an application or applet (e.g., an applet comprising executable code for a Java Virtual Machine) on the user computer **130** may send an authentication request signal to the authentication server **110**. Authentication server **110** may receive a given online profile information from the host server **120**, and determine whether computer **130** has been registered with the online profile information. Based on this determination at step **604**, the authentication server **110** (at step **606**) may send the appropriate registration status signal to the host server **120**, which in turn may update the online profile information to include the user's registration status. The host server **120** may share the user's online profile information and registration status indicator (see FIGS. **4** and **5**) with other user computers (i.e., anyone accessing the online service hosted by the server **120**).

With reference to FIG. **6**B, there is provided another embodiment of a user authentication system. In contrast to the system of FIG. **6**A, at step **604**, the user computer **130** receives the user's online profile information from the host server **120**, and sends the authentication request signal (including the online profile information) to the authentication server **110**. The authentication request signal may include the machine fingerprint and/or machine signature and/or online profile information. The authentication server **110** may receive the components of the authentication request signal, such as the online profile information, from the host server **120** and/or the user computer **130**. The rest of the system shown in FIG. **6**B is similar to the system shown in FIG. **6**A.

With reference to FIG. **7**A, there is provided another embodiment of a user authentication system, wherein the application or applet running on the user computer **130** may collect platform parameter data regarding the computer **130** and send the collected data to the authentication server **110** (at step **702**). The authentication server **110** in turn may generate the machine fingerprint regarding computer **130**, and save it along with the online account information from the computer **130** and/or the host server **120**. The rest of the system shown in FIG. **7**A is similar to the system shown in FIG. **6**A.

With reference to FIG. **7**B, there is provided another embodiment of a user authentication system, wherein the application or applet running on the user computer **130** may collect platform parameter data regarding the computer **130** and send the collected data to the authentication server **110** (at step **702**). As with the system of FIG. **7**A, the authentication server **110** may generate the machine fingerprint regarding computer **130**, and save it along with the online account information from the computer **130** and/or the host server **120** (at step **702**). However, in contrast to the system of FIG. **7**A, at step **704**, the user computer **130** receives the user's online profile information from the host server **120**, and sends the authentication request signal (including the online profile information) to the authentication server **110**. The rest of the system shown in FIG. **7**B is similar to the system shown in FIG. **7**A.

With reference to FIG. **8**, there is provided a method **800** for authenticating a user of an online service that may comprise retrieving data regarding an online profile of the user for the online service (step **802**), and collecting machine information regarding a computer being used by the user to access the online service (step **804**). The step of collecting machine information may include checking at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number of the computer. The step of collecting machine information may further include checking and using the IP address of the computer. At step **806**, a machine fingerprint is generated based at least in part on the collected machine information. At step **808**, the generated machine fingerprint and the retrieved online profile data are transmitted to an authentication server. The generated machine fingerprint may also be stored in a hidden file directory of the computer. The foregoing steps may be encoded as executable instructions in a computer-readable media, such as, for example, in a hard drive or in a portable media, such as an optical disk, electronic memory device, or magnetic tape, disk, or the like.

With reference to FIG. **9**, there is provided another method **900** for authenticating a user of an online service that may comprise retrieving data regarding an online profile of the user for the online service (step **902**), and collecting machine information regarding a computer being used by the user to access the online service (step **904**). In contrast to the method of FIG. **8**, a machine fingerprint is not generated; rather, at step **906**, the collected machine information and the retrieved profile data may be transmitted to the authentication server. The authentication server in turn may generate a machine fingerprint for the user computer. At step **908**, the machine fingerprint may be received from the authentication server. The received machine fingerprint may also be stored in a hidden file directory of the computer. The foregoing steps may be encoded as executable instructions in a computer-readable media, such as, for example, in a hard drive or in a portable media, such as an optical disk, electronic memory device, or magnetic tape, disk, or the like.

With reference to FIG. **10**, there is provided a method for authenticating a user of an online service that may comprise receiving a first machine fingerprint from a computer being used by the user (step **1002**). The first machine fingerprint may be generated from machine information regarding at least one of hard disk volume name, hard disk initialization date, processor type, and/or software serial number. The first machine fingerprint may be based at least in part on the IP address of the computer. At step **1004**, online profile information of the user for the online service may be received. The first machine fingerprint may be associated with the received online profile information (step **1006**). An authentication request signal may be received from the user (step **1008**), wherein the request signal comprises a second machine fingerprint. At step **1010**, the method may comprise determining whether the second machine fingerprint matches the first machine fingerprint. If so, a registered user signal may be transmitted to a server hosting the online service (step **1012**),

the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information. If the second machine fingerprint does not match the first machine fingerprint, another appropriate user registration signal may be sent to the server hosting the online service at step **1012**, resulting in the display of the appropriate registered status indicator (see FIGS. **4** and **5**). The foregoing steps may be encoded as executable instructions in a computer-readable media, such as, for example, in a hard drive or in a portable media, such as an optical disk, electronic memory device, or magnetic tape, disk, or the like.

In accordance with one or more aspects of the embodiments described herein, there is provided a computer-implemented method for controlling access to web content (or web site services). For example, the method may involve, for a user using a machine to attempt to access the web content, providing an opportunity to create a device identifier. The method may involve, on a computer, in response to the user opting to create the device identifier, gathering information regarding platform parameters of the machine and generating a unique device identifier based at least in part on the platform parameters.

The method may further involve storing the generated device identifier on the machine as a key file, and storing the generated device identifier at a remote site as a remote key file or the like. When the user attempts to access the web content, the method may involve: comparing the key file on the user's machine with the remote key file; and allowing access to the web content if the key file on the user's machine matches the remote key file.

In accordance with one or more aspects of the embodiments described herein, there is provided a computer-implemented method for verifying an online identity. For example, the method may involve, for a user using a machine to attempt to access a social networking site, providing an opportunity to create a device identifier. In response to the user opting to create the device identifier, the method may involve gathering information regarding platform parameters of the machine and generating a unique device identifier based at least in part on the platform parameters.

The method may further involve storing the generated device identifier on the machine as a key file, and storing the generated device identifier at a remote site as a remote key file or the like. When the user attempts to access the social networking site or the like, the method may involve: comparing the key file on the user's machine with the remote key file; and allowing access to the social networking site if the key file on the user's machine matches the remote key file.

In accordance with one or more aspects of the embodiments described herein, there is provided a client-side system for authenticating a user of an online service. For example, the system may comprise a first electrical component for retrieving data regarding an online profile of the user for the online service, and a second electrical component for collecting machine information regarding a network device, the collected machine information comprising at least one user-configurable parameter and at least one non-user-configurable parameter. The system may comprise a third electrical component for generating a device identifier based at least in part on the collected machine information, and a fourth electrical component for storing the generated device identifier in a hidden file directory of the network device. The system may comprise a fifth electrical component for transmitting the generated device identifier and the retrieved online profile data to an authentication server or the like.

In accordance with one or more aspects of the embodiments described herein, there is provided a server-side system for authenticating a user of an online service. For example, the system may comprise a first electrical component for receiving a first device identifier from a network device being used by the user, the first device identifier being generated from at least one user-configurable parameter and at least one non-user-configurable parameter of a client-side network device. The system may comprise a second electrical component for receiving online profile information of the user for the online service.

The system may comprise a third electrical component for associating the first device identifier with the received online profile information, and a fourth electrical component for receiving an authentication request signal from the user, the request signal comprising a second device identifier. In response to the second device identifier matching the first device identifier, the system may comprise a fifth electrical component for transmitting a registered user signal to a server hosting the online service, the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information.

While the present invention has been illustrated and described with particularity in terms of preferred embodiments, it should be understood that no limitation of the scope of the invention is intended thereby. Features of any of the foregoing methods and devices may be substituted or added into the others, as will be apparent to those of skill in the art. It should also be understood that variations of the particular embodiments described herein incorporating the principles of the present invention will occur to those of ordinary skill in the art and yet be within the scope of the invention.

As used in this application, the terms "component," "module," "system," and the like are intended to refer to a computer-related entity, either hardware, firmware, a combination of hardware and software, software, or software in execution. For example, a component can be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a computing device and the computing device can be a component. One or more components can reside within a process and/or thread of execution and a component can be localized on one computer and/or distributed between two or more computers. In addition, these components can execute from various computer readable media having various data structures stored thereon. The components can communicate by way of local and/or remote processes such as in accordance with a signal having one or more data packets (e.g., data from one component interacting with another component in a local system, distributed system, and/or across a network such as the Internet with other systems by way of the signal).

It is understood that the specific order or hierarchy of steps in the processes disclosed herein is an example of exemplary approaches. Based upon design preferences, it is understood that the specific order or hierarchy of steps in the processes may be rearranged while remaining within the scope of the present disclosure. The accompanying method claims present elements of the various steps in sample order, and are not meant to be limited to the specific order or hierarchy presented.

Moreover, various aspects or features described herein can be implemented as a method, apparatus, or article of manufacture using standard programming and/or engineering techniques. The term "article of manufacture" as used herein is intended to encompass a computer program accessible from any computer-readable device, carrier, or media. For example, computer-readable media can include but are not limited to magnetic storage devices (e.g., hard disk, floppy

disk, magnetic strips, etc.), optical discs (e.g., compact disc (CD), digital versatile disc (DVD), etc.), smart cards, and flash memory devices (e.g., Erasable Programmable Read Only Memory (EPROM), card, stick, key drive, etc.). Additionally, various storage media described herein can represent one or more devices and/or other machine-readable media for storing information. The term "machine-readable medium" can include, without being limited to, wireless channels and various other media capable of storing, containing, and/or carrying instruction(s) and/or data.

Those skilled in the art will further appreciate that the various illustrative logical blocks, modules, circuits, methods and algorithms described in connection with the examples disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, methods and algorithms have been described above generally in terms of their functionality. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

What is claimed:

1. A computer-implemented method for authenticating a user of an online service, comprising:

retrieving, by a network device, data regarding an online profile of the user for the online service, the network device being used by the user to access the online service;

collecting, by the network device, machine information regarding the network device, the collected machine information comprising at least one user-configurable parameter and at least one physical non-user-configurable property of the network device, wherein the at least one physical non-user-configurable property comprises a carbon and/or silicon degradation characteristic of a network device component;

generating a device identifier based at least in part on the collected machine information;

storing the generated device identifier in a hidden file directory of the network device; and

transmitting the generated device identifier and the retrieved online profile data to an authentication server.

2. The method of claim **1**, further comprising, in response to the generated device identifier matching a known identifier, receiving a registered user signal from the authentication server.

3. The method of claim **2**, wherein the registered user signal comprises instructions for an online service server to include a registered status indicator in the user's online profile information.

4. The method of claim **3**, wherein the registered status indicator is based at least in part on past behavior or reputation associated with the user.

5. A non-transitory computer readable medium comprising executable code for a Java Virtual Machine (JVM) to:

retrieve data regarding an online profile of a user for an online service;

collect machine information regarding a network device being used by the user to

access the online service, the collected machine information comprising at least one user-configurable parameter and at least one physical non-user-configurable property of the network device, wherein the at least one physical non-user-configurable property comprises a carbon and/or silicon degradation characteristic of a network device component;

generate a device identifier based at least in part on the collected machine information;

store the generated device identifier in a hidden file directory of the network device; and

transmit the generated device identifier and the retrieved online profile data to an authentication server.

6. The non-transitory computer readable medium of claim **5**, further comprising executable code for the JVM to, in response to the generated device identifier matching a known identifier, receive a registered user signal from the authentication server.

7. The non-transitory computer readable medium of claim **6**, wherein the registered user signal comprises instructions for an online service server to include a registered status indicator in the user's online profile information.

8. The non-transitory computer readable medium of claim **7**, wherein the registered status indicator is based at least in part on past behavior or reputation associated with the user.

9. A computer-implemented method for authenticating a user of an online service, comprising:

receiving, by an authentication server, a first device identifier from a network device being used by the user, the first device identifier being generated from at least one user-configurable parameter and at least one physical non-user-configurable property of the network device, wherein the at least one physical non-user-configurable property comprises a carbon and/or silicon degradation characteristic of a network device component;

receiving, by the authentication server, online profile information of the user for the online service;

associating the first device identifier with the received online profile information;

receiving an authentication request signal from the user, the request signal comprising a second device identifier; and

in response to the second device identifier matching the first device identifier, transmitting a registered user signal to a server hosting the online service, the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information.

10. The method of claim **9**, wherein the registered status indicator is based at least in part on past behavior or reputation associated with the user.

11. A computer program product, comprising:

a non-transitory computer-readable medium comprising code for:

receiving a first device identifier from a network device being used by a user, the first device identifier being generated from at least one user-configurable parameter and at least one physical non-user-configurable property of the network device, wherein the at least one physical non-user-configurable property comprises a carbon and/or silicon degradation characteristic of a network device component;

receiving online profile information of the user for the online service;

associating the first device identifier with the received online profile information;

receiving an authentication request signal from the user, the request signal comprising a second device identifier; and

in response to the second device identifier matching the first device identifier, transmitting a registered user

signal to a server hosting an online service, the registered user signal comprising instructions for the server to include a registered status indicator in the user's online profile information.

12. The computer program product of claim **11**, wherein the registered status indicator is based at least in part on past behavior or reputation associated with the user.

13. A computer-implemented method for authenticating a user of an online service, comprising:

retrieving, by a network device, machine information regarding the network device, the machine information comprising at least one user-configurable parameter and at least one physical non-user-configurable property of the network device, wherein the at least one physical non-user-configurable property comprises a carbon and/or silicon degradation characteristic of a network device component;

generating a device identifier based at least in part on the retrieved machine information; and

transmitting the generated device identifier to an authentication server.

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